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ABSTRACT

The nature of group decision support systems (GDSS), its key advantages, and the experience of using it with several classes help illustrate that this type of computer technology can serve an important function in supplementing instruction of the small group course. The primary purpose of a GDSS is to improve group decision-making and effectiveness by removing communication barriers, providing structuring techniques for decision analysis, and systematically directing the pattern, timing, and content of group discussions. Advantages of GDSSs in education include: (1) text printout and automatic data storage; (2) availability of structured tools; (3) combination of face-to-face and electronic communication; (4) opportunity for repeated use as a supplemental form of instruction; (5) greater equality of participation; and (6) anonymity. The biggest drawback of GDSS is that it is not yet widely available. The experience of various classes at San Diego State University (California) indicates that the usage rates and role, process, and outcome satisfaction were high. The use of GDSS in small group communication courses deserves further exploration, research, and incorporation. (A diagram of an Electronic Boardroom GDSS is included; 24 references are attached.) (RS)

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Using Group Decision Support Systems in Teaching the Small Group Communication Course

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A recent development in the ongoing search to improve group interaction is the advent of computer-mediated communication technologies. While computer bulletin boards (CBBs), electronic mail (EM), and computer conferencing (CC) have received a great deal of attention from the academic and business communities (see, for example, Hellweg, Berman, & Smith, 1985; Rice, 1988; Steinfield, 1986), substantially less is known about the application of these technologies in the classroom. While CBB, EM, and CC have been utilized specifically for small group classes (D'Souza, 1991; Phillips & Santoro, 1989), this has only occurred in very limited cases. A number of researchers (e.g., D'Souza, 1991; Phillips & Santoro, 1989; Romiszowski & de Haas, 1989) have called for further exploration into the use of computer-mediated technologies for instructional purposes.

Group decision support systems (GDSSs) represent a technological aid for the decision-making process that has not yet been examined in the educational context. In eliminating some of the barriers to effective interaction, GDSSs combine communication, computer and

decision technologies to support problem formulation and solution in group interaction (DeSanctis & Gallupe, 1987; Watson, DeSanctis, & Poole, 1988). This paper argues that the GDSS can be used to supplement the traditional small group course. In order to support this contention, we will begin by examining the nature of GDSSs and how they compare to other computer-mediated communication technologies used in education. Second, we shall discuss several advantages and disadvantages of using GDSSs. Next, I will document several cases in which I utilized the GDSS in small groups and similar classes. Finally, we will discuss conclusions and directions for future work in this area.

GDSS Overview

Definition and Purpose

There is not yet complete agreement in the literature about what constitutes a GDSS (Kraemer & King, 1988). Huber (1984, p. 195) defined a GDSS as "a set of software, hardware, and language components and procedures that support a group of people in a decision-related meeting." DeSanctis and Gallupe (1985, p. 191) defined it as "an interactive computer-based system, which facilitates solution of

unstructured problems by a set of decision-makers working together as a group." Watson (1987, p. 1) offered a definition of GDSSs as a combination of "computer, communication, and decision-support technologies to support decision-making teams." The common elements in the three definitions are computers, groups, communication, and decisions.

The primary purpose of a GDSS is to improve group decision-making and effectiveness by removing communication barriers, providing structuring techniques for decision analysis, and systematically directing the pattern, timing, and content of group discussions (DeSanctis & Gallupe, 1987). GDSSs aim to reduce "process losses" associated with member dominance and inhibited expression while at the same time aiming to add "process gains" that increase efficiency of group processes and outcomes (Watson, 1987).

Levels, Dimensions, and Meeting Scenarios

DeSanctis and Gallupe (1987) classify three levels of GDSSs. Level 1 systems "provide technical features aimed at removing common communication barriers..." (p. 593). This level improves the decision process by facilitating communication between participants. Level

2 systems provide decision modelling and techniques aimed at reducing noise and uncertainty in the decision-making process. As Sage (1991) noted, this might include a system with software that could be used for problem solution. Level 3 systems involve machine-induced group communication patterns and can include expert advice to be applied during a meeting. Electronic versions of parliamentary procedure and other structuring devices would also be part of a Level 3 system. The transition between the levels is not distinct, and it is often not easy to determine at what level a GDSS is operating (Sage, 1991).

Most researchers classify meeting scenarios based upon member proximity and group size. Both DeSanctis and Gallupe (1987) and Dennis, George, Jessup, Nunamaker, and Vogel (1988) classified small groups at one group site, which most closely resembles the small group communication course, as "decision rooms."

Features

While there are different types of GDSSs, most have several common features. DeSanctis and Gallupe (1985) summarized them as follows: (a) specially designed and not configurations of existing computer systems; (b) specifically designed to support decision-

makers; (c) require minimal computing skills and are easy to use; (d) may be specific or general in regard to suitability for various tasks; and (e) contain built-in mechanisms that discourage negative group behaviors.

The GDSS package includes hardware, software, organizationware, and people (DeSanctis & Gallupe, 1987; Kraemer & King, 1988). The hardware includes the conference facility itself and the computing, teleconferencing, and audio/visual equipment. This includes complete computer terminals for each participant, a common viewing screen, and a central computer for data storage and/or facilitation.

The software components include databases, specialized application programs, and flexible user interfaces. It may include high level programming languages and model bases. Basic features include text and data file creation; word processing; tutorials; on-line help; worksheets, spreadsheets, and decision-trees; and state-of-the-art database management. Group features may include numerical and graphical summarization; prompting menus; specialized group procedure programs (such as weighting of votes, anonymity, elimination of redundant input, etc.); and

text and data transmissions between group members.

Organizationware includes the organizational data, group processes, and management procedures for group meetings. The people include not only the participants, but the system facilitator as well. Nunamaker, Applegate, and Konsynski (1988) pointed to anonymity of inputs, facility design, public screens, databases, network speed, and software designs as some of the most important features of the GDSS.

Comparing GDSS to Other Technologies

It is important to identify some of the characteristics that distinguish GDSSs from other forms of computer-mediated communication technologies used for instructional purposes. Four of the most important features are (a) proximity of users, (b) synchronicity, (c) independence from mainframe system, and (d) specifically structured for group interaction.

Perhaps the most unique feature of the GDSS is that it is not well-suited for distance-based education. Instead of connecting geographically separated individuals, interaction over a GDSS typically occurs with all members in the same physical location. Gallupe & McKeen (1990, p. 2) have noted that "the development of systems to support the

activities of face-to-face groups is a relatively new application of computer technology." Whereas most interaction and instruction involving other computer technologies would take place entirely over the electronic channel, GDSSs are capable of utilizing both electronic and face-to-face communication.

Additionally, the primary form of interaction on the GDSS is synchronous, or real-time. Davie and Wells (1991) report that most education conducted with computer-mediated communication is done asynchronously. Asynchronicity allows others to respond several minutes, or several days, after an initial request or message was sent. The GDSS, on the other hand, facilitates immediate feedback and nearly simultaneous interaction.

A third key difference from other computer technologies is that the GDSS is not tied to the mainframe computing system. It is entirely self-sustaining and exists in one set location. Phillips and Santoro (1989, p. 157) noted that "a major problem encountered in the development of CMC-based instruction is that mainframe systems are customarily user unfriendly." The GDSS, on the other hand, is designed specifically with the user in mind.

Last, the GDSS is specifically structured for group communication, making additional system adjustments unnecessary before interaction may take place. While computer conferencing is similar in this respect, conferencing systems usually lack the specific tools and programs found on the GDSS that serve to facilitate a wide range of group needs.

GroupSystems and the Electronic Boardroom

The GDSS at San Diego State University, where the author's current work was completed (Scott, 1992a, 1992b), is referred to as the Electronic Boardroom. It consists of 14 stations with a terminal and keyboard arranged around a conference table. This GDSS is modelled after the one at the University of Arizona and uses software called GroupSystems.

A public viewing screen is at the front of the room, and a facilitator to help administer the meeting is also present (see Figure 1). Comments are made anonymously, and use of the equipment requires only minimal training. The software tools available include electronic brainstorming, idea organization, voting, topic commentator, alternative evaluation, policy formulation, group dictionary, group questionnaire, stakeholder identification, and issue analysis (San

Diego State University, 1990).

Specific tools available on GDSSs are similar across various systems. The SAMM (Software-Aided Meeting Management) GDSS pioneered by the University of Minnesota includes brainstorming, idea evaluation (weighting, rating, ranking, and voting), decision aids (stakeholder analysis, allocation model, paired-comparisons, snow card, and problem formulation), and meeting thoughts (Dickson, Poole, & DeSanctis, 1989). The tools at Xerox's Colab include brainstorming, organizing, evaluation, proposing, and arguing (Stefik et al., 1987).

Advantages/Disadvantages of GDSSs in Education

Now that we know more about the GDSS in general, it is essential that we assess the advantages and disadvantages of using such a system, particularly for a small group communication course. The goal is not to replace traditional face-to-face instruction, but to supplement it. The advantages may be divided into the following areas: (a) text printout and automatic data storage, (b) structured tools available, (c) combination of face-to-face and electronic communication, (d) opportunity for repeated use as a supplemental form of instruction, (e) greater equality

of participation, (f) anonymity, (g) ease of usage, (h) increased affect, and (i) the ability to explore effects of changing group variables.

Text and Data

An important advantage of using computer-mediated instruction is that it automatically keeps a record of the interaction. Romiszowski and de Haas (1989) noted that each class member can have a permanent record of the course. The GDSS can produce records of individual communicators, group interaction as it occurs, comments on specific topics only, or even use key words to sort and classify comments. Davie and Wells (1991) note that text-based communication safeguards against forgetfulness and challenges participants to be accountable for their work. These authors even suggest using the transcripts for instructional activities to promote student reflection and to allow students to look back and see growth and development. The GDSS would easily facilitate such projects and can produce many different types of interaction transcripts.

Furthermore, the GDSS can be used for storage and retrieval. Group meetings can be resumed in the next class at the point where they were interrupted. The GDSS can store comments, ideas, and votes and save them

for subsequent meetings. Drafts of group projects can be kept and retrieved. Additionally, the GDSS can record important data about individual users (e.g., demographics, amount of participation).

Structured Tools

Certainly one of the greatest advantages for using a GDSS to help teach small group communication is that this type of system is designed specifically for use by groups. The tools available on the GroupSystems software allow groups to brainstorm ideas, organize those ideas, comment on specific topics, make decisions, formulate policies, evaluate alternatives, analyze issues, identify stakeholders, and vote upon decisions. Each of these functions is performed by a separate tool designed specifically for that activity. One can see how various aspects of group decision making, which continues to be a central function of most groups, could be explored via the GDSS.

Additionally, tools for group writing and survey assessment are available also. Each program tool may be used separately, or as is more often the case, in conjunction with other tools on the system. The instructor, who may also serve as the facilitator for using the GDSS, can control which tools to use on

certain days for certain activities.

Combining Face-to-Face and Electronic Channels

GDSSs were not intended to be a complete replacement for face-to-face interaction; consequently, their use in an educational context would be in addition to more traditional modes of instruction. Since the GDSS has all participants meeting in the same place at the same time, a combination of face-to-face and electronic channels is easily facilitated. Davie and Wells (1991) observed that face-to-face meetings may be important in assuring that the learner feels as though he or she is part of a group. Using the GDSS in the way described here would allow for this.

Furthermore, this combination emphasizes both oral and written communication skills in group interaction. Traditional forms of instruction or courses done solely over electronic media often lack this. Not only can this afford an instructor the opportunity to further develop both types of communication skills, but it offers the student who may be deficient in one mode or the other an alternative means of expression. Furthermore, since some studies have reported that students feel awkward without the nonverbal cues provided by face-to-face meetings (D'Souza, 1991), the

combination interaction GDSS provides is especially important.

Repeated Use as a Supplement

As I've tried to emphasize, the GDSS is not designed (nor should it) to be a complete alternative in instructing the small groups course; instead, it is an addition. However, repeated use over the course of a quarter or semester term is essential. Users typically become more at ease with usage over time. Additionally, the GDSS experience should be more than some field trip to play with the latest technological advancement in the age-old attempt to improve group efficiency. New tools can be utilized and the system should be used to explore new areas of group communication theory as the semester progresses. Several areas are discussed below. However, the point is that frequent and repeated use of the GDSS will offer the greatest advantage for the class.

Equal Participation

GDSSs have the advantage of allowing all users to input at the same time. For a group of communication students, this could translate into a free-for-all where no one has to ever stop talking, or in this case, typing. However, the advantage comes in that no one

individual or group of people can dominate discussion to the extent that others do not have time to make their feelings or thoughts known. It is well known that such domination can and does occur in traditional instruction. Davie and Wells (1991) note that this is also the case in audio and video conferencing instruction.

Although the research results are somewhat mixed (see Scott, 1992a for review), there is a general feeling that GDSSs tend to equalize participation, at least moreso than traditional forms of interaction. This can be especially useful in a classroom situation where conversation often is dominated by one (the instructor) or a small coalition of people.

Anonymity

The anonymity of participants is arguably the critical feature of most GDSSs. Comments appear on the public and individual screens, but no one knows who has expressed what. The lines are not "tagged" as they might be in other computer-based instruction systems. The goal behind this is forcing people to focus on the content of messages rather than the status of the individual who sends the remark. The developers of GDSSs operate under the assumption that poor decisions

are often the result of more attention being paid to who says something that what has actually been said. This is a problem with any group situation, whether in the boardroom or the classroom.

Anonymity can be frustrating, especially at first. However, the benefits are several. Individuals whose ideas are traditionally ignored or not highly valued may be able to get a hearing using the GDSS. Decisions and votes have to be made on the content of the arguments and the facts around them, which is what we typically tell our students they should be based upon, rather than the clout of powerful individuals. Ideas may be criticized, but not people; this begins to teach students about how to interact in groups and how to deal with conflict and argument.

Again, the anonymity in the system may make it possible to involve those students who might not participate otherwise due to shyness or fear of criticism. However, Romiszowski and de Haas (1989) have noted that computer conferencing users begin to attach certain characteristics to messages as they become more experienced. It is also possible that class members will begin attributing remarks (correctly or incorrectly) to individuals after repeated use.

Additionally, it is also possible to go back into the system as determine those comments that came from specific user stations. This may be useful in providing each member with a transcript of their own comments.

Ease of Usage

Largely because GDSSs are designed for the average decision maker, and not a computer expert, the system is very user friendly. Again, it is not part of a complicated mainframe system, but is entirely self-driven. The simple commands used across the various group tools minimize the necessary training prior to system use. This ease helps create an environment in which students are eager to learn and not frustrated about how to do so.

Increased Affect

Kraemer and King (1988) contend that the affective benefits of a GDSS include livening up meetings and creating cohesion due to the interest created by computer graphics, voting, and other processes. The state-of-the-art graphics and electronics on the GDSS are indeed an advantage. Color monitors and the large-print public viewing screen create a visually stimulating environment. As Van Horn (1991) notes,

student learning can be greatly facilitated by the use of color pictures and other visual effects.

Changing Group Variables

The ultimate advantage in using the GDSS in the small groups course is the ability to explore effects of changing group variables. Outcomes such as satisfaction (process, role, and outcome), quality of decision, time until decision is reached, effectiveness, etc. can be assessed under various conditions. Most commonly, a class could use the GDSS to make comparisons between face-to-face, GDSS, and combination meetings. As technologies continue to grow, making such an assessment is a needed part of the small group curriculum.

Once the class has a feel for the uniqueness of GDSS interactions, other issues can be investigated through various exercises. Davie and Wells (1991) contend that synchronous exercises provide an instructor with a real opportunity to empower the student. The GDSS can be used to explore the effects of different sized groups, seating arrangements at various terminals, and time restrictions. Additionally, discussions of leadership and leadership emergence may be initiated.

The GDSS can be used to explore a variety of tasks. Several of the different tools lend themselves in this fashion. A preference allocation task might use the topic commenter to discuss issues and criteria, while a distributive task such as survival on the moon might move right to a rank order vote. Brainstorming and issue analysis tools are also useful here.

Decision making and voting can be explored in great detail on a GDSS. San Diego State's system allows for five different types of voting (e.g., yes/no, percentage, rank order). Additionally, quick vote functions allow the group to assess each others' thinking as discussion progresses. The system also has features that allow users to monitor change over the course of voting, degree of consensus in a vote, and a variety of other statistics important to group process. All of these can be used to educate students about the ways in which groups function.

Disadvantages

Along with the several advantages of using GDSSs outlined above, a set of drawbacks exist as well. Perhaps the biggest of these is simply that GDSSs are not widely available yet. Easton (1991) reports that such systems only exist in about a dozen universities

and a handful of large corporations at this time. Additionally, the GDSSs that do exist are typically housed in the information resources or management departments, not communication or speech.

Secondly, some may view the fact that the GDSS cannot be used to instruct an entire on-line class as a limitation. While I have addressed reasons countering this, it is true that GDSSs are more limited in this respect than most other forms of computer-mediated communication. For similar reasons, the GDSS is not at all suited for distance education. Because it is physically fixed, students must come to it. This also means that the GDSS cannot be transported to the typical college classroom (without a great deal of difficulty). Instead, it is up to the class to meet where the GDSS is located.

Phillips and Santoro (1989, p. 159) claim that "asynchronicity is the main benefit" in teaching group problem solving. While arguments exist on both sides, it is true that a GDSS is not well suited for this type of interaction. To the extent that this is more inconvenient than other forms of interaction, it is disadvantageous.

Additionally, the computer-mediated nature of the

GDSS may make it seem cold and impersonal, especially at first. Consequently, this may discourage some users from actively taking part. D'Souza (1991) noted that a small minority of students in her study reported that this form of communication was too impersonal.

Other barriers to successful use of GDSSs are present as well. Dickson et al. (1989) list technological and staff limitations, lack of adequate meeting facilities, and lack of institutional support and money to operate a system. Kraemer and King (1988) add technological problems and an incomplete understanding of the decision-making process of groups in general.

Classroom Examples

The examples discussed briefly here all come from the author's work with various classes while conducting GDSS research at San Diego State University. Although that research is not reported here, several experiences seem relevant to this paper. In general the usage rates and role, process, and outcome satisfaction for the various classroom groups that participated on the GDSS were high (although no comparison to face-to-face interaction is available here).

Two small groups classes visited the GDSS. In the

small section (n = 13) the entire class participated at once, while the assigned project groups in the other section each came for their GDSS meeting separately. In both cases, the instructor expressed enthusiasm about the possibilities on the GDSS. One teacher held an informal discussion about the pros and cons of using the GDSS and then had the students write a paper regarding this topic.

A leadership group from the military science department also met on the GDSS as part of this research. Their instructor required the participants to write a paper about the effects of the GDSS on leadership, addressing such issues as who the leaders normally are, who they were in this task, and how anonymity affected both. The feelings about the GDSS from this group were mixed. Most were very impressed about the use of technology in this area, but concerned about the inability to identify formal command.

Perhaps the most interesting group to use the system was a project team from an advanced course in the instructional education department. This group was naturally curious (and somewhat critical of the IBM equipment!) about the GDSS. In exchange for having the group participate in my research, I then facilitated a

meeting for them. The project team was putting together a multimedia presentation to introduce newcomers to the department. Our meeting began by brainstorming on the GDSS about what the different steps in this process should be. Having completed this, the ideas were then synthesized through some face-to-face interaction. Next, the list of activities was sent back out to the participants on the topic commenter tool to generate discussion on how the items should be prioritized. This was interspersed with the rank order voting tool. After meeting for about one hour fifteen minutes, the group had identified and prioritized the steps needed to accomplish their task. They had done so with minimal personal conflict and in the time they had allotted themselves. Participants reported after the meeting that the greatest benefit of the GDSS was in allowing so many ideas to be expressed. The transcripts of the meeting, which also included the voting, then proved to be invaluable to the group as they went back to begin the project.

Several communication courses that had divided their class into small groups for various projects also contributed groups, but unfortunately no formal instruction was incorporated by the instructor. The

participants were, however, debriefed and offered an opportunity to ask questions about the GDSS. Additionally, several classes from the management and marketing departments were using the GDSS to explore bargaining and focus group interaction.

Conclusion

The nature of the GDSS, its key advantages, and the experience of using it with several classes help illustrate that this type of computer technology can serve an important function in supplementing instruction of the small group course. When used for this, the GDSS seems better suited than other forms of electronic communication, largely because it is designed with group interaction in mind. The numerous exercises and activities that are part of the typical small group courses can be explored in detail with the GDSS.

As noted above, there are barriers to using GDSSs in any classroom. However, as these tools become more and more available over the coming years, it is important that we as educators prepare ourselves for the possible opportunities. Phillips and Santoro (1989) have stressed the importance of creating courseware that supports instruction and not the

machinery. Similarly, the strength of the medium needs to be considered when focusing attention to the learner (Romiszowski & de Haas, 1989). Additionally, it is up to the instructor to determine for what parts of the course the GDSS is suited (e.g., exercises, group writing, evaluations) and what portions are better handled in more traditional fashion (e.g., lecturing). The instructor would also have to act as the facilitator for the GDSS interactions, which puts him or her in a unique task and socioemotional leadership position.

Future work in instruction and education should focus on ways that new computer and communication technologies can be used to supplement our basic courses. Exploring such areas will allow us to determine how we can best utilize the advances being made. The GDSS in the small group communication course is only one of several possibilities, but it is an important one that deserves further exploration, research, and incorporation.

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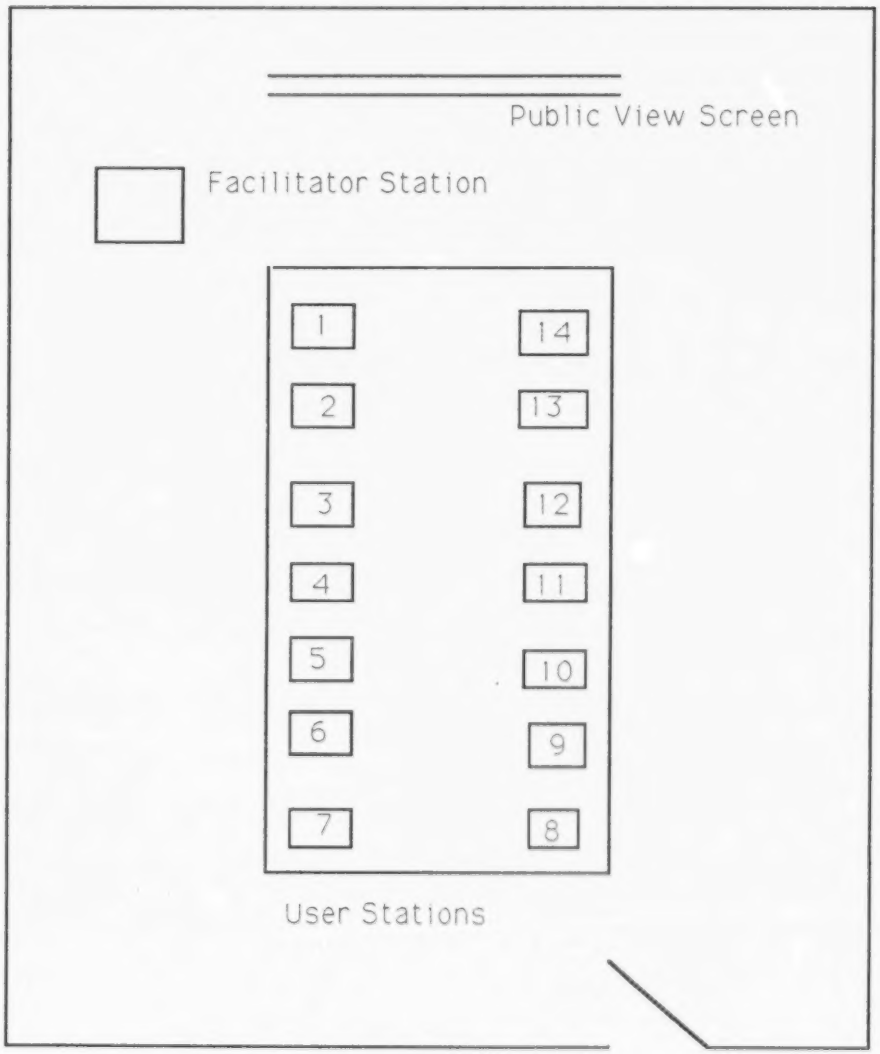

Figure 1: Diagram of Electronic Boardroom GDSS